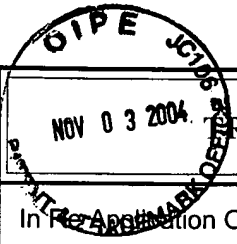


JW AF/1764



NOV 03 2004

TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.
2000B047

In Re: Application Of: J. C. Cheng, et al.

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/619,560	July 19, 2000	W. D. Griffin	23455	1764	2046

Invention: Alkylaromatics Production

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on September 2, 2004

The fee for filing this Appeal Brief is: \$330.00

- ☐ A check in the amount of the fee is enclosed.
- ☐ The Director has already been authorized to charge fees in this application to a Deposit Account.
- ☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 05-1712
- ☐ Payment by credit card. Form PTO-2038 is attached.

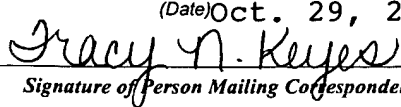
WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.


Signature

Dated: October 29, 2004

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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 Cf. : 1.8(a)] on	
(Date)	Oct. 29, 2004
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Tracy N. Keyes	
Typed or Printed Name of Person Mailing Correspondence	

cc:



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Inter Patent Application of:)	
J. C. Cheng et al.)	
Confirmation No. 2046)	
Serial No. 09/619,560)	Examiner: W.D. Griffin
Filed: July 19, 2000)	Group Art Unit: 1764
For: ALKYLAROMATICS PRODUCTION)	
Customer No. : 23455		

APPELLANTS' BRIEF UNDER 37 CFR 1.192(a)

Mail Stop Appeal Brief-Patents

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants appeal the Primary Examiner's final rejection of the claims set forth in the Office Action of Examiner Griffin mailed June 8, 2004 to the honorable Board of Patent Appeals and Interferences ("Board").

As required, the Appeal Brief is being filed in triplicate.

Please charge the fee of \$330 for the fee required under 37 CFR 1.17(c) to Deposit Account No. 05-1712. Enclosed is a duplicate copy of this sheet.

1. Real Party in Interest

The real party in interest is ExxonMobil Chemical Patents Inc. of Houston, Texas.

2. Related Appeals and Interferences

No related appeals or interferences exist at this time.

3. Status of the Claims

Claims 1, 3-14, 16-24, 27 and 28, inclusive, are before the Board for consideration.

4. Status of Amendments

No amendments after final rejection have been filed.

5. Summary of the Invention

The present invention relates to a process for producing monoalkylated aromatic compounds from polyalkylated aromatic compounds contacted with alkylatable aromatic compounds under at least partial liquid phase conditions and in the presence of a transalkylation catalyst. The transalkylation catalyst comprises a mixture of at least: (i) a first crystalline molecular sieve having a X-ray diffraction pattern including d-spacing maxima at 12.4 ± 0.25 , 6.9 ± 0.15 , 3.57 ± 0.07 and 3.42 ± 0.07 Angstrom, e.g., MCM-22; and (ii) a second crystalline molecular sieve different from the first molecular sieve and selected from zeolite beta and mordenite.

6. Issue

Did the Examiner err in finally rejecting Claims 1, 3-14, 16-24, 27, and 28 under 35 USC 103(a) as being unpatentable over U.S. Patent No. 3,385,906 to Kaufman in view of U.S. Patent No. 5,557,024 to Cheng et al. (Cheng)?

7. Grouping of Claims

Appellants submit that all of the claims stand or fall together, with the exception of claims 19 to 22, inclusive. Claim 19 is limited to a process for producing cumene, which process is more specifically supported by the Examples and Declaration of Dr. Cheng showing unexpected results. Similarly, claims 20 to 22, inclusive are directed to specific combinations of molecular sieves whose first molecular sieve component is MCM-22, which are exemplified in the Examples and Declaration.

8. Arguments

A. Rejection Under 35 USC 103

The Examiner has finally rejected Claims 1, 3-14, 16-24, 27 and 28 under 35 USC 103(a) as being unpatentable over U.S. Patent No. 3,385,906 to Kaufman in view of U.S. Patent No. 5,557,024 to Cheng.

The Examiner argues that Kaufman teaches producing cumene by alkylation followed by transalkylation of diisopropyl benzene. Specifically, Kaufman is cited as teaching reaction of benzene with propylene in the presence of an alkylation catalyst to produce cumene-containing product from which is separated a majority of cumene. The remaining effluent is combined with benzene and transalkylated over a catalyst such as zeolite Y. The Examiner acknowledges that Kaufman fails to disclose the presently claimed process of using a mixture of two different molecular sieves, the co-extrusion step of claim 6, the weight percentage of transalkylation catalyst as it relates to the crystalline sieves as required by claims 5 and 18, or the alkylation catalyst of claim 14. Further, the Examiner relies on the Cheng reference for its disclosure of the use of MCM-22, MCM-49, zeolite Y, zeolite beta and mordenite, including TEA-mordenite as transalkylation catalysts. According to the Examiner, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the process of Kaufman by utilizing a combination of any two of the transalkylation catalysts disclosed by Cheng because each of these is individually used as a transalkylation catalyst. The Examiner further argues i) co-extruding the catalyst as required by present claim 6 would have been obvious given Cheng's disclosure of extrusion as a common method for production of a catalyst, ii) using MCM-56 alkylation catalyst as disclosed by Cheng in transalkylation would have been obvious to one skilled in the art because of MCM-56's "high activity and selectivity for the desired alkylated product" and iii) one skilled in the art would have utilized small crystal (less than 0.5 micron) TEA-mordenite inasmuch as Cheng discloses its use as a transalkylation catalyst.

Appellants respectfully disagree with the Examiner's conclusion of obviousness and request the Board to consider the following arguments.

Kaufman teaches the use of zeolites such as faujasite, and zeolites L and Y, in transalkylation of benzene and by-products of benzene alkylation with propylene, but fails to disclose or suggest any of the presently claimed molecular sieves, much less the combinations of MCM-22 type material and zeolite beta or MCM-22 type material and mordenite, for which surprising results have been shown.

The Examiner cites *In re Kerkhoven*, 626 F.2d 846, 850 (CCPA 1980), for the proposition that it would be obvious to combine any two transalkylation catalysts, in any weight percentage including those claimed, and that such a combination would be expected to be effective. However, it must be noted that *In re Kerkhoven* addressed a combination of two dried detergent compositions for improving physical flow characteristics, not a combination of two catalysts for reducing by-product formation in a chemical process. It is further noted that the *Kerkhoven* failure to provide data commensurate in scope with the claims was not relative to percentages of components being combined, but rather to the failure to test against the components taught in the prior art.

It has long been established that catalysts are generally considered unpredictable merely from the chemical nature of the catalyst. *See, Corona Co. v. Dovan* (USSC 1928) 276 US 358, 369. Catalytic effects are not ordinarily predictable with certainty. *See, In re Doumani et al.* (CCPA 1960) 281 F.2d 215, 126 USPQ 408. Further, the effect of the modification of one prior art catalytic process in a manner employed in another prior art process which employs a different catalyst was held unpredictable. *See, Ex parte Berger et al.*, (POBA 1952) 108 USPQ 236. To find obviousness, "there must be some reason for the combination other than the hindsight gleaned from the invention itself." *Interconnect Planning Corp. v. Feil*, 227 USPQ 543, 551 (Fed. Cir. 1985). Stated in another way, "[I]t

is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." *In re Fritch*, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992). For this reason, it is respectfully submitted that the decision of *In re Kerkhoven* does not apply to the present invention which is a combination of specified catalysts out of a multitude of possibilities.

The Examiner has acknowledged that "catalytic effects are generally unpredictable," but nevertheless argued against Appellants' position because Cheng "clearly discloses that catalysts comprising MCM-22, MCM-49, zeolite Y, zeolite beta, and mordenite are suitable transalkylation catalysts" so that "one could predict with a high degree of certainty that a mixture of any of these catalysts would be effective to some extent in a transalkylation process." Office Action mailed June 8, 2004, paragraph bridging pages 4 and 5, emphasis added. However, the Examiner has not accurately characterized Cheng whose salient passage actually teaches "[t]he transalkylation catalyst may be a catalyst comprising a zeolite such as MCM-49, MCM-22, PSH-3, SSZ-25, zeolite X, zeolite Y, zeolite beta, or mordenite." Col. 14, lines 27 to 30, emphasis added. Thus, it can hardly be said that Cheng teaches or suggests *any* multi-molecular sieve component catalyst for use in transalkylation, much less the specific combination claimed by Appellants. Instead, the reference teaches or suggests, at best, a variety of single zeolite transalkylation catalysts. Indeed, this would actually teach away from the invention as presently claimed. Moreover, Cheng's Example 7 teaches that "MCM-56 has at least 4 times the capacity of MCM-22 and MCM-49 for 1,3,5-trimethylbenzene." Column 19, lines 47-50. Cheng's Example 13, relating to liquid phase synthesis of cumene from benzene and propylene states that "MCM-56 retained good product selectivity, comparable to MCM-22" while "[z]eolite beta performed poorly for cumene synthesis." Column 22, lines 64-67. These teachings actually provide a disincentive to one skilled in the art working with polyalkylaromatics to produce cumene for adding seemingly less effective molecular sieves to MCM-56, particularly MCM-22 and zeolite beta--components which are typically present in the transalkylation catalyst of the presently claimed process. Such teachings belie the Examiner's contention at page 5, first

full paragraph of the June 8, 2004 office action that "[o]ne having ordinary skill in the art would expect any combination of known effective transalkylation catalysts to be effective in a transalkylation process."

It is well understood that the teaching of a reference *as a whole* should be considered. In *In re Wesslau*, 353 F.2d 238, 147 USPQ 391 (CCPA 1965), the court cautioned that "it is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." In *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 230 USPQ 416 (Fed. Cir. 1986), *cert. denied*, 484 U.S. 823 (1987), *on remand*, 10 USPQ2d 1929 (N.D. Calif. 1989), the Federal Circuit held that a single line in a prior art reference should not be taken out of context and relied upon with the benefit of hindsight to show obviousness. Rather, a reference should be considered as a whole, and portions arguing against or teaching away from the claimed invention must be considered.

Even assuming that Cheng provides the routineer in the art with an expectation of effectiveness "*to some extent* in a transalkylation process," for a combination of molecular sieves, as posited by the Examiner at page 5, lines 7-9 of the June 8, 2004 office action, such a disclosure should be considered as no more than an invitation to try various catalyst combinations of the catalysts disclosed by Cheng. Cheng's description states that a suitable transalkylation catalyst "may be a catalyst comprising a zeolite such as MCM-49, MCM-22, PSH-3, SSZ-25, zeolite X, zeolite Y, zeolite beta, or mordenite." Col. 14, lines 28-30. This listing, in combination with the list provided by Kaufman, provides 10 individual selections and hence 10 factorial possible combinations, i.e., 3,628,800 possibilities. As noted above, a careful parsing of the grammatical construction of Cheng's disclosure shows it actually teaches *away* from *any* combination of catalysts. While Cheng does indicate that n-propylbenzene, ethylbenzene, and other impurities should be kept very low, preferably less than 100 to 300 ppm, there is no

teaching of the concept of combining two unrelated transalkylation catalysts to achieve such a beneficial result. When the prior art has not recognized the result effective capability of a particular invention parameter, no expectation would exist that optimizing that parameter would be successful. *See, In re Antonie*, 559 F.2d 618, 195 U.S.P.Q. 6 (C.C.P.A. 1977).

In industrial practice, each individual catalyst performs optimally in a different combination of operating conditions, and there would be no motivation to combine catalysts that operate optimally at different conditions. Cheng does not in any way indicate that the catalysts are interchangeable with respect to a given set of operating conditions. Appellants note that their specification at page 2, lines 12-14, states that there is "a significant problem in the case of cumene production where existing catalysts have either lacked the desired activity or have resulted in the production of significant quantities of by-products such as ethylbenzene and n-propylbenzene." Accordingly, it is respectfully submitted that one skilled in the art would not have been led to the present invention if acquainted with Kaufman and Cheng references. Moreover, these references neither teach nor suggest the unexpected improvements obtained by the combinations of molecular sieves in the process of the invention now claimed. Appellants thus respectfully submit that there is no motivation in either the Kaufman or the Cheng reference to combine the specific molecular sieves as presently claimed. It is well-settled law that obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. *In re Geiger* (CAFC 1987) 815 F2d 686, 2 USPQ2d 1276; *In re Fine* (CAFC 1988), 5 USPQ2d 1596.

Appellants also note that the data supplied in Table 1 of the present specification for beta, mordenite, and MCM-22 individually show that each catalyst performs differently. Although all accomplish transalkylation, each accomplishes 50% conversion at a different WHSV and with different levels of selectivity and by-product formation. It is respectfully submitted that these differences would indicate to one of ordinary skill in

the art that specific molecular sieves, while performing the same category of reaction, do so in different ways and further, that they are not so closely related as to make a combination of any two molecular sieves obvious. The Examiner has tried to counter this argument by noting that "[t]here is no evidence that the effective operating conditions for any one of the catalysts disclosed by Cheng is different from any other disclosed catalyst." However, this assertion fails on its face inasmuch as Table 1 of the present specification clearly shows that beta, mordenite, and MCM-22, each of which is disclosed by Cheng, performs differently with specific optimal conditions for effective operation.

Appellants thus respectfully submit that there is no *prima facie* case of obviousness, and further that there is no suggestion to combine the teachings of Kaufman et al. with those of Cheng et al. Even assuming a *prima facie* case of obviousness has been established, which it has not, then Appellants have rebutted that case with evidence of unexpected results.

In response to Appellants' arguments that the claimed process produces superior and unexpected results given the data provided in the Examples of the specification and in the declaration of Dr. Jane Cheng, the Examiner argues that the showing made by the experimental data is not commensurate with the scope of the presently claimed invention inasmuch as the "claims are not limited to the data points provided and there is no reason to believe that the limited data provided could be extrapolated to all percentage combinations of the catalysts." It is respectfully submitted that a showing of surprising results should not then be used to limit the scope of the invention to specific data points.

Appellants respectfully submit that the crux of the present invention is not a combination of a given percentage of two catalysts, but the discovery of a surprising benefit from combining the specific catalysts disclosed and claimed. There is nothing in the prior art to suggest that the combination of crystalline molecular sieves having a certain X-ray diffraction pattern with selected other crystalline molecular sieves would yield a synergistic effect on the production of by-products in aromatics transalkylation

reactions. The catalyst combinations yielding such an effect have been discovered by Appellants. While certain percentage combinations are preferred, having established the benefits of the combination itself, Appellants respectfully submit that the benefit is not limited to the range established by the data submitted. Thus, the claims are commensurate with the surprising results shown for the combinations tested.

The data provided by Appellants in Table 1 and in the Declaration by Dr. Cheng indicate that the benefit with respect to a given impurity would be expected to trace a curve separate from the line created by a weighted average of the properties of each catalyst individually. For example, the selectivity for unwanted n-propylbenzene by-product achieved with MCM-22 alone (Example 3) was 0.104%; with TEA-mordenite alone (Example 4), a selectivity of 0.086% was achieved; however with a 1:1 ratio of the two (Example 5), a selectivity of 0.077% was achieved. The mixture surprisingly gave a selectivity that was not only lower than the weighted average "expected" value of 0.095%, it gave a selectivity to an undesired by-product that was lower than was achievable using either catalyst alone. Further, Table A of Dr. Cheng's declaration (Example 8) shows that for a 2:1 ratio of MCM-22 to TEA-Mordenite, the n-propylbenzene selectivity was 0.075% as compared to an "expected" weighted average value of 0.098%. There would be no scientific reason for assuming that the benefit was limited to the range tested. Rather the two data points for the mixtures and the two data points for the individual catalysts (endpoints) provide four data points which sufficiently define curves which would indicate that all percentage combinations of the identified catalysts would be expected to yield a benefit.

Minimal experimentation would be required for one of ordinary skill in the art to choose molecular sieve catalyst mixtures from those disclosed by Appellants or the percentages to use in order to optimize with respect to a given by-product at the desired operating conditions. It is important that the Board note that Appellants are not in a situation in which the specification of ranges is required to distinguish from prior art, and should therefore, in the event a combination is found to be *prima facie* obvious, only have

to show that the combination has been tested and found superior to the closest prior art, as would have been required for the Appellant to prevail in *In re Kerkhoven*. The closest prior art in this situation is the use of either molecular sieve alone.

It is respectfully noted that there is no teaching in the references cited by the Examiner that would indicate any expectation of superior results from a combination of catalysts. It is again noted that catalysis is an unpredictable art, hence there is no clear expectation of success with a combination of two different molecular sieves.

If a person of ordinary skill in the art would have been surprised by the applicant's results, then the invention could not have been obvious. "The principle applies most often to the less predictable fields, such as chemistry, where minor changes in a product or process may yield substantially different results." *In re Mayne*, 104 F.3d 1339, 1343 (Fed. Cir. 1997), quoting *In re Soni*, 54 F.3d 746, 750, 34 USPQ2d 1684, 1687 (Fed. Cir. 1995).

In earlier cases involving chemical inventions, the courts and the Board have held that a showing of unexpected results rebutted a *prima facie* case of obviousness. *See, e.g., In re Hedges*, 783 F.2d 1038, 1041, 228 USPQ 685, 687 (Fed. Cir. 1986); *In re May*, 574 F.2d 1082, 1094-95, 197 USPQ 601, 611 (CCPA 1978); *In re Orfeo*, 440 F.2d 439, 442, 169 USPQ 487, 489 (CCPA 1971); *Ex parte Ebata*, 19 USPQ2d 1952, 1956 (Bd. Pat. App. & Int. 1991).

In this case, Appellants have provided objective evidence of unexpected results, and the Examiner has shown no basis for concluding that these results would not apply to the full range of the invention disclosed and claimed. Scientific support for the conclusion of unexpectedness has been provided both in the specification and in the Declaration of Dr. Cheng. As required by *In re Oetiker*, 977 F.2d 1443, 24 USPQ 1443 (Fed. Cir. 1992), the Appellants have met the burden of preponderance of the evidence to support unexpected results from the invention claimed.

Further it is noted that with respect to enablement, the federal courts have said: [T]o provide effective incentives, the claims must adequately protect inventors. To demand that the first to disclose shall limit his claims to what he has found will work or to materials which meet the guidelines specified for "preferred materials" in a process such as the one herein involved would not serve the constitutional purpose of promoting progress in the useful arts. *In re Goffe*, 542 F.2d 564, 567, 191 USPQ 429, 431 (CCPA 1976).

It is respectfully submitted that this reasoning applies as well to a situation in which the Appellants have provided sufficient data to extrapolate the results over the range claimed, notwithstanding the Examiner's observation that Appellants have argued that the catalyst art is unpredictable. Notwithstanding the foregoing arguments as to the adequacy of the scope of the evidence of unexpected results to support the present claims, Appellants note that claims 20 to 22 are directed to specific combinations of molecular sieves exemplified in the application and Declaration of Dr. Cheng, i.e., MCM-22/zeolite beta or MCM-22/TEA-mordenite. Thus, the Examiner's argument at the second full paragraph of page 5 of the June 8, 2004 office action that "[t]he claims are not limited to these combinations" is incorrect.


Appellants submit that the combination of Kaufman in view of Cheng fails to disclose or suggest the subject matter of the present claims, for the reasons given above. Accordingly, it is respectfully requested that the Honorable Board reverse this rejection under 35 USC 103(a).

CONCLUSION

Appellants respectfully submit that the foregoing arguments obviate the Examiner's final outstanding rejection in this case. The present claims describe a process for producing monoalkylated aromatics over a transalkylation catalyst comprising a mixture of at least two crystalline molecular sieves, which is new, useful and unobvious and otherwise meets the statutory requirements for patentability. Accordingly, reversal of the final rejection by the Board is earnestly solicited.

Respectfully submitted,

29 October 2004

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9. APPENDIX

CLAIMS:

1. A process for producing a monoalkylated aromatic compound comprising the step of contacting a polyalkylated aromatic compound with an alkylatable aromatic compound under at least partial liquid phase conditions and in the presence of a transalkylation catalyst to produce a monoalkylated aromatic compound, wherein the transalkylation catalyst comprises a mixture of at least:

(i) a first crystalline molecular sieve having an X-ray diffraction pattern including d-spacing maxima at 12.4 ± 0.25 , 6.9 ± 0.15 , 3.57 ± 0.07 and 3.42 ± 0.07 Angstrom; and

(ii) a second crystalline molecular sieve different from the first molecular sieve and selected from zeolite beta and mordenite.

3. The process of claim 1, wherein the first crystalline molecular sieve is selected from MCM-22, MCM-36, MCM-49 and MCM-56.

4. The process of claim 1, wherein the second crystalline molecular sieve comprises TEA-mordenite having an average crystal size of less than 0.5 micron.

5. The process of claim 1, wherein the transalkylation catalyst comprises about 15 to about 50% by weight of the first crystalline molecular sieve, based on the total weight of molecular sieve material in the catalyst.

6. The process of claim 1, wherein the transalkylation catalyst is produced by coextrusion of said mixture of at least two different crystalline molecular sieves.

7. The process of claim 1, wherein the alkyl groups of the polyalkylated aromatic compound have 1 to 5 carbon atoms.

8. The process of claim 1, wherein the polyalkylated aromatic compound is polyisopropylbenzene and the alkylatable aromatic compound is benzene.

9. The process of claim 1, wherein said contacting step is conducted at a temperature of 100 to 260°C, a pressure of 10 to 50 barg (1100 to 5100 kPa), and a weight hourly space velocity of 1 to 10 on total feed, and a weight ratio of alkylatable aromatic compound to polyalkylated aromatic compound of 1:1 to 6:1.

10. A process for producing a monoalkylated aromatic compound comprising the steps of:

- (a) contacting an alkylatable aromatic compound with an alkylating agent in the presence of an alkylation catalyst to provide a product comprising said monoalkylated aromatic compound and a polyalkylated aromatic compound, and then
- (b) contacting the polyalkylated aromatic compound from step (a) with said alkylatable aromatic compound under at least partial liquid phase conditions and in the presence of a transalkylation catalyst to produce a monoalkylated aromatic compound, wherein the transalkylation catalyst comprises a mixture of at least:
 - (i) a first crystalline molecular sieve having an X-ray diffraction pattern including d-spacing maxima at 12.4 ± 0.25 , 6.9 ± 0.15 , 3.57 ± 0.07 and 3.42 ± 0.07 Angstrom; and
 - (ii) a second crystalline molecular sieve different from the first molecular sieve and selected from zeolite beta and mordenite.

11. The process of claim 10, wherein the alkylation step (a) is conducted under at least partial liquid phase conditions.

12. The process of claim 10, wherein the alkylation step includes an alkylating aliphatic group having 1 to 5 carbon atoms.

13. The process of claim 10, wherein the alkylating agent is propylene and the alkylatable aromatic compound is benzene.
14. The process of claim 10, wherein the alkylation catalyst of step (a) is selected from MCM-22, MCM-49, MCM-56 and zeolite beta.
16. The process of claim 10, wherein the first crystalline molecular sieve of the transalkylation catalyst of step (b) is selected from MCM-22, MCM-36, MCM-49 and MCM-56.
17. The process of claim 10, wherein the second crystalline molecular sieve of the transalkylation catalyst of step (b) comprises TEA-mordenite having an average crystal size of less than 0.5 micron.
18. The process of claim 10, wherein the transalkylation catalyst of step (b) comprises about 15 to about 50% by weight of the first crystalline molecular sieve based on the total weight of molecular sieve material in the catalyst.
19. A process for producing cumene comprising the steps of:
- (a) contacting benzene with propylene under at least partial liquid phase conditions and in the presence of an alkylation catalyst to provide a product comprising cumene and polyisopropylbenzenes, and then
 - (b) contacting the polyisopropylbenzenes from step (a) with benzene under at least partial liquid phase conditions and in the presence of a transalkylation catalyst to produce further cumene, wherein the transalkylation catalyst comprises a mixture of at least:
 - (i) a first crystalline molecular sieve having an X-ray diffraction pattern including d-spacing maxima at 12.4 ± 0.25 , 6.9 ± 0.15 , 3.57 ± 0.07 and 3.42 ± 0.07 Angstrom; and

(ii) a second crystalline molecular sieve different from the first molecular sieve and selected from zeolite beta and mordenite.

20. The process of claim 1, wherein the first crystalline molecular sieve is MCM-22.
21. The process of claim 20 wherein the second crystalline molecular sieve is TEA-mordenite.
22. The process of claim 10, wherein the first crystalline molecular sieve is MCM-22 and the second crystalline molecular sieve is TEA-mordenite.
23. The process of claim 1, wherein the transalkylation catalyst comprises about 15 to about 50% by weight of the second crystalline molecular sieve based on the total weight of molecular sieve material in the catalyst.
24. The process of claim 10, wherein the transalkylation catalyst comprises about 15 to about 50% by weight of the second crystalline molecular sieve based on the total weight of molecular sieve material in the catalyst.
27. The process of claim 1, wherein the transalkylation catalyst comprises about 30 to about 50% by weight of the first crystalline molecular sieve based on the total weight of molecular sieve material in the catalyst.
28. The process of claim 10, wherein the transalkylation catalyst comprises about 30 to about 50% by weight of the first crystalline molecular sieve based on the total weight of molecular sieve material in the catalyst.